IT-based modeling for organizational capability management

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Abstract

Competency management is becoming a strategic issue at all company levels to improve industrial performances. In this field of concern the organizational capability approach aims at guaranteeing coordinated development of shared, collective competencies on several entities (plants, functional departments, etc…) around key objectives. The aim of this paper is to provide a generic IT-based model to manage (transfer, assess, improve) these organizational capabilities. Then two specific applications derived from this model are given to illustrate its operational use in the context of an important automotive supplier.

Keywords

Competency management, Industrial engineering, Organizational capability

1. Introduction

Competency is defined as the aptitude of an actor to put in practice a set of knowledge and environmental resources in a specific context so as to achieve some objectives.

- Competency can be considered according to the level of the concerned actor. This can be:
  - *individual,* relative to an elementary actor, like human resource competency, and in some extent, process capability and capacity for machines (Amherdt et al., 2000).
  - *collective,* for a single organizational entity, e.g. the competency of a purchasing service in a plant to buy raw material with good price and good quality (Vaudelin, 2002), or for the whole organization (e.g. the competency of the purchasing department of the company to impose a quality policy to all the suppliers, which can be thus become a core competency of the company (Sanchez et al., 1996).
- Competency can also be regarded according to:
  - *A process based view,* by defining competency according to predefined processes it has to support (Armistead, 1999). The competency becomes therefore a criterion to allocate the actors on the activities of the organization. It is reduced to a kind of "technical competency" or "hard competency" (Mc Clelland, 1973), and its definition changes when the activities change.
  - *A resource based view,* by defining competency as a capital of knowledge used to master the different aspects of the mission given to the actor (Tarafdar and Gordon, 2007). The competency is then more long-term defined: it is a kind of "behavioral competency" or "soft competency", based on the mastering of "business knowledge", which can be used whatever the operational processes chosen.

In order to manage all these dimensions of the competency concept, different approaches exists. All of them aims at developing competencies in a local (acquired by a unique individual or organizational entity) or shared mode (guaranteeing the polyvalence of the employees or the interoperability of entities). Nevertheless, these approaches differ,

according to the properties of level and management view described above, as emphasized in Figure 1.

- *Qualification approach:* it is one of the earliest human resource approaches, supported by the “Fordian” idea that there is a stable relationship between individual skills, length of service and workstation (Houé et al., 2006).
- *Individual competency approach:* It consists in characterizing an actor by the set of competences he possesses and can set to work, instead of assessing a worker by comparing pre-defined activities and actor’s ability to perform them (Zarifian, 2002).
- *Quality approach:* It focuses on the justification of the competencies of people involved in the business processes, so as to determine if a department, a plant, or an organization masters its activities (Houé and Grabot, 2009).

However, there is a « missing » approach, focused on the management of collective competencies according to a resource-based view. On one hand, quality methods, like ISO norms (ISO, 2010) or CMMI (SEI, 2010), are focused on defining the competencies after modeling the processes (sometimes, the process areas are even standardized, like in CMMI). On the other hand, the individual competency approaches, like CRAI (Bério and Harzallah, 2007) or sarC (Boucher, 2003), attempt sometimes to use their models at a collective level, by aggregation techniques, but the collective competency cannot always be define as a sum of individual competencies, and depends on some collective or organizational knowledge and capabilities. Another approach is therefore necessary:

- *Organizational capability approach:* It is used to develop collective and shared competencies (between plants, departments, business units) around corporate and business objectives, so as to maintain or improve the operational performance of a company and its organizational cohesion (Fall, 2008).

Level / Management view	Process view	Resource view
Individual	Qualification approach	Individual competency approach
Collective	Quality approach	Organizational capability approach

Figure 1. Competency management approach

The paper deals with this organizational capability approach and it aims at building a generic IT-based model to support its management (definition, deployment, assessment, improvement) in the organizations. Section 2 provides an overview of the related works achieved to define and model organizational capability. As illustrated in Figure 1, the modeling elements of quality approach and individual competency approach are studied to extract the building concepts of organizational capability (because they share either the management view or the level properties of organizational capability). This state of the art enables to design in section 3 an UML model of organizational capability, whose properties and the main points are discussed in the perspective of using it in an operational way. Section 4 illustrates the use of this model through two developed applications deployed in the context of a major automotive supplier. Finally a discussion is led on the use of this model for managing effectively and efficiently organizational capabilities.

2. Related Works

So as to provide an IT-based modeling of organizational capabilities, this part studies the definition and the characteristics of capabilities. Then the individual competency and the quality approaches are studied to extract the concepts, the relationship and the point of view which are used in section 3 to build the model.

2.1 Organizational capability, a multi-level concept between knowledge and results

(Saint-Amant and Renard, 2004) defines organizational capabilities as “know how to act, a potential of action resulting from the combination and the coordination of resources, knowledge and competencies of the organization, and which can be expressed through the activities of the value flow, to fulfill strategic objectives”.
This definition points out some pregnant characteristics:

- *Key organizational aptitudes:* Organizational capabilities constitute the key aptitudes that a company must develop and assess to gain a competitive advantage and to determine the status of its strengths and its weaknesses (de Pablos & Lytras, 2008).
- *Potential performance built by knowledge acquisition and resources synergy:* Organizational capabilities emerged from the synergies of organizational resources, which continuously progress thanks to the acquisition of knowledge and competencies (generally modeled under the form of corporate best practices). They are thus related to organizational learning (Lorino, 2001), and knowledge acquisition evaluation can be regarded as a mean to assess organizational capabilities as “potential performance” (Lebas, 1995).
- *Driver of real performance expressed in activities:* Moreover organizational capabilities can be expressed through the value flow, it is to say that their use should generate a performance improvement in the activities of organization (Rauffet(a), 2009). Performance indicators trends can therefore provide a means to assess organizational capabilities as “real performance” drivers.
- *Local and shared capabilities:* Finally all the organizational resources are involved in achieving corporate objectives. At a local level organizational capability is the synergy of human, physical and structural resources of an entity around the defined strategic objectives. At upper levels organizational capability is the synergy of entities which developed share the same corporate practices and developed locally the same organizational capability.

The view of organizational capability as a construct related to knowledge acquisition and resource synergy, as well as the duality between potentiality (organizational can induce a performance improvement) and reality (activities results expressed the use of organizational capabilities) must be kept in mind so as to model and assess organizational capabilities.
Moreover, the definition of organizational capability is rather similar to the definition of competency. They are both an “aptitude” or a “potential”, they are both based on combination and use of knowledge and resource, they are both finalized, it is to say they aim at achieving an objective through an activity. It is quite natural because organizational capability is a particular kind of competency. But the definition of competency is very often applied only for “individual” competency, where the actor is a single human, not an organizational entity.
It is why the modeling elements used for individual competencies could therefore be studied to model organizational capabilities, but in keeping in mind the collective nature of

organizational capabilities. Models from quality approach can provide this collective point of view on competency.
The following paragraphs provide an overview on the existing models coming from the individual competency and the quality approaches, and emphasize the main concepts of these models which are kept to model organizational capability in part 3.

2.2 Modeling elements from individual competency approach and quality approach

2.2.1 Individual competency approach

The individual competency approach has been explored this last decade by many works, which propose models for managing individual competencies: CRAI (Harzallah et Vernadat, 2002), sarC (Boucher, 2003), the competency systemic model, later referenced in the paper by CSM (Boumane et al., 2006), the extended competence framework model, later referenced in the paper by ECFM (Houé and Grabot, 2006), UECML (Pépiot et al, 2007)... These models differ in many points, especially in the goal they aim at and in the way they are implemented: for instance both CRAI and ECFM develop a software based on their model so as to assess individual competencies and their adequacy to organizational needs, and to identify the needs of trainings or qualification correcting an inadequacy; CSM is more focused on the understanding on how the actor gathers knowledge and resources to build a dynamic competency, according to a situation, and propose some theoretical mechanisms to enrich the competency management. Nevertheless, some common concepts and relationships are shared among all these different works, and could be used for modeling the specific competency which is the organizational capability.
- The main objects:
  - *Entity (Actor):* all the models in the literature emphasize the notion of actor, it is to say the entity (here it is an individual, but it could be a team, or a plant at a collective level) which produces results by carrying out some activities and by putting in practices the competency it acquired. Some models keep this dynamic term (the actor is the one which acts), some others (like CRAI) prefers to deal with the static concept of “individual”, by detailing its dynamic characteristic in the relationships with other concepts. Indeed “individual” always exists, whereas the definition of “actor” is dependent of and cannot be defined without “action”. For the proposed model of organizational capability, the term “entity” is used: it can be understood at different level, encompassing the notion of individual but also any kind of groups, and keeps the static description of “individual”.
  - *Mission:* this concept is also commonly used by the different cited approaches. This is the essential function of an entity. This term is often used at an individual level to detail the field of activities an individual has to master. This term exist also at a strategic, organizational level, to explain the long-term general objective of the organization. This long-term mission can be expressed in the achievement of some short-term operational objectives, in the obtainment of activities results. It is also expressed into the functional requirements of competency that entity has to acquire.
  - *Aspect:* Some models, like CRAI or the systemic model, use the concept of aspect to define the functional / knowledge area covered by the mission and which must be mastered by the competency. Some other models, like ECFM, use the notion of roles based on the work of (Mintzberg, 1979) and (Hermosillo et al., 2005), which is a group of functions that entity has to achieve. These notions are quite symmetric: the entity plays

different roles to achieve its mission, and the mission has several aspects that entity must master. For the modeling of organizational capability, only the term “aspect” is kept, to avoid semantic redundancy.

- *Knowledge / Environmental resources:* The authors do not find a consensus around the concept used to describe on which elements the entity acts to build its competency and use it. Some works consider that competency is only a construct built from knowledge, know-how, know-whom and know-be (CRAI, ECFM, UECML). Some others (sarC) represents competency rather as a lever to link entity with some environmental resources, and do not detail the knowledge used to create this link. Finally, CSM presents competency as a selection, a combination and a use of both knowledge and environmental resources. This point of view will kept for the modeling of organizational capabilities, so as to distinguish the “material” means (machines, software, collaborators…) and the “immaterial” means (knowledge, know-how…). Moreover, knowledge and resources can be at different organizational levels: a resource for a production service can be the R&D center or a machine, a knowledge for the production service can be the quality policy of the group (like TPM for Toyota) or the know-how of an operator on a specific machine.
- *Situation:* Finally there is still a main concept shared by some literature’s models (sarC, CSM): the notion of situation takes into account the context where the mission is achieved, where the knowledge and the resources exists or not and are activated by the entity, and finally where the competency is implemented. A competency exists only if the conditions of the context of use enable its expression. For instance a medical team can cure some strong diseases in an equipped hospital but it would not be able to save its patients in a desert without its tools. The situation is therefore an important parameter to define the required competency according to the properties of the entity, but it has also to be taken into account to understand how entity acquire competency and why the acquired one could be different from the required one.

- The main relationships :
  - *The required / acquired link:* competency is considered as the interface between mission and entity. This relationship is used to assess competency, by observing the adequacy between what entity acquires and what mission requires (similarly to the qualification approach which assess the adequacy between entity and process). As mentioned by (Beriot and Harzallah, 2005), this assessment is thus based on strong hypotheses: required competencies must be clearly and completely defined to be coherent with the whole mission of the entity, and the proofs, the guiding elements to check if an entity has acquired competency must be also clearly and completely modeled. These hypotheses point out the huge importance of the phase of competency design (focused on the definition of what the mission requirements are, and how these requirements can be obtained) and assume that the expert designing the competency system is reliable. They also do not take into account the notion of situation, which can cause some interference even if the design phase is accurate (a generic competency model can be applied for the training of medical teams, it would be sufficient for teams working in hospital environment but not for the ones which operate in the desert for instance).
  - *the link with activity and the notion of result:* Some models from the literature conserve a part of the process-based view of competency, linking activity and competency (sarC, ECFM). In some extent, activity can be considered as the use of the competency in a specific situation by an entity so as to achieve its mission. However,

activity is by essence dynamic. In the modelling of organizational capabilities the static concept of result (as activity « product ») is kept. This concept, encapsulating the dynamic notion of activity, can also be use to provide an indicator on the "real" behavior of the capability in a situation, and to potentially enable to identify the limits due to the hypotheses presented above in the required / acquired relationship (Rauffet(b), 2010).

As emphasized above, the concepts and links from the modeling of the individual competency can be reused for the modeling of the organizational capability. Nevertheless, some concepts and links must be taken carefully to understand them at a collective level, like for instance the mission and its aspects, the notion of knowledge and resource (which are not only at an elementary individual level, but can also be organizational), the link with activities, etc. So as to detail and refine the understanding of these concepts and links, models coming from quality approach are studied in the following section.

2.2.2 Quality approach

The quality approach is based on the creation and the deployment of good practices libraries, to guide organization in the control or the maturity of their processes, like ISO or CMMI, or their projects, like P3M (Gonzalez-Ramirez, 2008). So they aim at organizing and assessing collective competencies of the organization around some key processes defined according to some recommendations (like part 4 of ISO9000 norm) or even defined completely (decomposition of CMMI in process areas for instance). Even if these models are "process" oriented, some collective characteristic can be identified and added to enrich the modeling of organizational capability.

- The main objects:
  - *Operational and functional objectives:* They differentiate operational and functional objectives in the achievement of the mission, and focus on the fulfillment of the functional ones. Indeed mission expects the reach of some results given that a specific situation, and mission requires capabilities covering some of its aspects.
  - Knowledge and process area: So as to structure the capabilities, the existing methods require and use the definition of the organizational processes (ISO9000), or define a priori a set of process area (CMMI) or knowledge area (PM3). It is a means to avoid forgetting an "aspect" of the mission given to the entity.
- The main relationships:
  - General to specific decomposition: The mission is decomposed, from general objectives to specific objectives. Following the Management By Objectives (Drucker, 1976) used to detail the objectives of the firm into the operational objective, methods like CMMI or PM3 use the notion of general and specific requirements.
  - « Axiomatic design » -like principles: the structure of the quality guide (ISO) or the maturity model (CMMI, PM3) differentiate and link the requirements (what the organization needs) from the practices (what the entities use to act), in an "axiomatic design" fashion (Suh, 2001). Practices are not always an operational means (it does not detail which software, which machine or which tool must be used to improve the activities' performance), but it could constitute a guiding list (find a tool which can be used with such constraints, create and implement a method which answers to such criteria…) to answer the requirement. In some extent, it is the way to detail how capability is acquired (guiding characteristic), and what the "proofs" are to check if the entity acquired well the capability (assessing characteristic).

The extracted concepts and the relationships from the individual competency and the quality approach are rather static and focused on the structure of capabilities. The next section explores the dynamic dimension of the concept and identifies different modes of use of the structural view of organizational capability.

2.3 Dynamic aspects of organizational capability concept: learning, use and improvement

Many work are focused on how manage dynamically capabilities, by optimizing the acquisition of organizational practices by the different entities of a company. The research works on good practices transfer (Szulanski, 2006), on organizational learning (Senge, 1990), on learning loops (Argyris, 1978, Le Boterf, 2003) are studied and synthesized in (Rauffet(c), 2009), and they used hereafter to extract some clues to appreciate the management rules of organizational capabilities:

- *Formal work / practical work:* Capabilities can be seen as the product of the formal work of experts (which gather and structure the organizational good practices around functional objectives) or as a contextualized means of action for entities (which use capabilities to succeed their activities and achieve their operational objectives).
- *The triple loop learning (transfer, feedback, sharing of practices):* On one hand capabilities requirements and practices are deployed on the operational ground according to some transfer mechanisms (Szulanski, 2006, Nonaka, 1994). On the other hand the learning entities use the capability structure to share their experience and some new good practices. According to (Le Boterf, 2003), who enriches the previous work of (Argyris and Schoen, 1978), the entity can either in a single loop adapt its behavior to what it is asked for, propose in a second loop some improvements on the requirements and practices the organization gives to it, or adopt in a socialized third loop the capabilities and share them with other autonomously. This triple loop learning is based on:

    - *Learning schema and path dependency:* the capabilities are acquired by entities by learning. For individual competencies, (Beriot and Harzallah, 2007) refer for instance to e-learning techniques, for quality approach, some good practices libraries propose a structure to guide the learning (like CMMI or PM3, with the notion of maturity level). According to (Boumane, 2006), the learning dynamics can be captured in the notion of schema, it is to say the organization of learning elements, like operational invariants, inferences rules, etc (Murray and Donegan, 2003). Moreover, the notion of maturity level is finally related to an intrinsic property of organizational capability: the path dependency, which claims the status of organizational capability acquired by entities is dependent on the way (the different past states) the entities learn the capabilities (Metcalfe and Andrew, 2000).
    - *Contextual learning:* as explained above, the capabilities must be deployed according to the situation of its potential use. It is why learning objectives (maturity level to reach, delay to achieve the functional objective) must be discussed before. The capability structure becomes therefore a support for negotiating the efforts to do between organization and its entities. Furthermore, the situation plays also a huge in the capability acquisition, in considering the “triple loop” of Le Boterf (when entities adopt capabilities and share them with others). Indeed, entities can learn from others so as to learn more quickly the capabilities, by looking for some similarities in the context of other entities (Rauffet(b) , 2010), and by constituting thus some “communities of practices” (Wenger, 2000), or CoPs, around capability structures.

The main concepts, relationships and dynamic modes were extracted from this brief state of the art. They are used in the next section to build an IT-based model of organizational capabilities and their management modes.

3. Proposition of an IT-based organizational capability modeling: the *C-makers* Model

This section present an IT-based organizational capability modeling based from the previous state of the art. Then a management framework defines the key tools to use so to manage capabilities. Some developments are provided in section 4 to make these key tools operational.

3.1 Organizational capability modeling

As illustrated in Figure 2, the previous state of the art on the models of individual competency and quality approach enables to build an organizational capability model, called C-makers ("C" for Capability, and "makers" for the other concepts which "make up" the capability).
Moreover, so as to represent this model, UML language is chosen, so as to enable its use for a future software development, to explain further the different management modes of the organizational capability object and finally to integrate these ones into an organizational capability management framework.

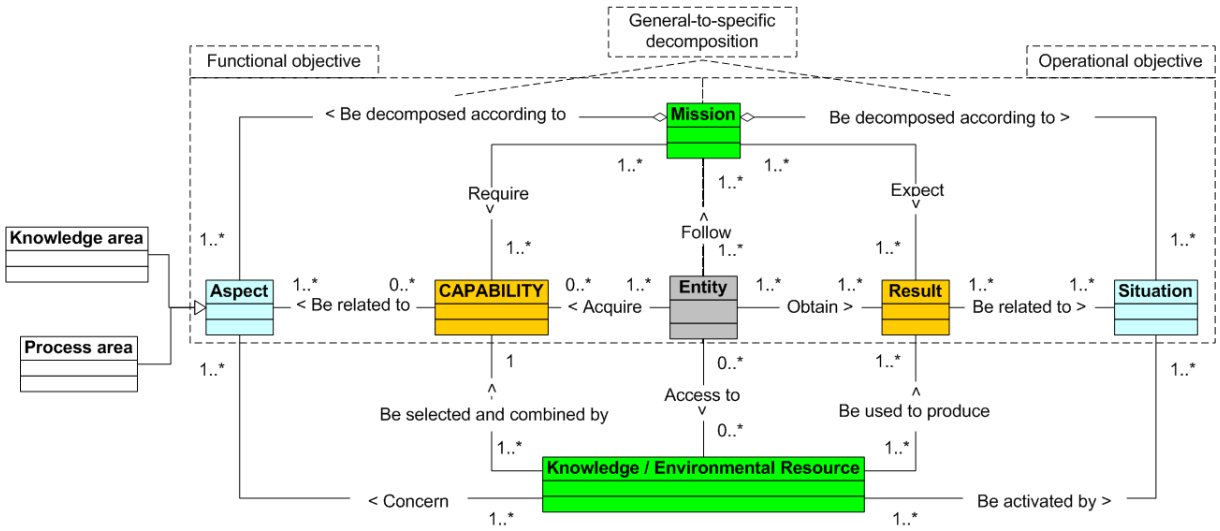

Figure 2: IT-based modeling of organizational capability: the symmetric *C-makers* model

As emphasized in the quality approach (dotted box of Figure 2), a mission (general) can be decomposed (specific) according to:
- some aspects, which are covered by one or more capabilities. This is a functional objective.
- some situations, in which a result is expected. This is an operational objective.
The entity follows the mission, has to acquire the capabilities required by and the results expected by the mission in a given situation. To do that, the entity has access to some knowledge and some environmental resources. These one can be activated or not in a given situation, they are selected and combined by the capabilities of the entity so as to be mobilized in the obtainment of the results expected by the mission. Furthermore, these knowledge and environmental resources belong to some aspect, which can be knowledge area (like in PM3 method) or process area (like in CMMI).

This *C-makers* model represents the organizational capability with a « static » and “usage” point of view. The next section aims at adding the dynamic elements of the state of the art, by studying organizational capability with a “learning” and “management” point of view.

3.2 Management modes and global framework

The following paragraphs deal with the key management objects which enable to manage the concept and the relationships presented above in Figure 2. The elements of assessment and triple loop learning, mentioned in the state of the art of part 2, are especially studied.

3.2.1. Organizational capability assessment mechanisms

The assessment of capabilities is generally based (cf. 2.2) on the difference existing between required and acquired capabilities. However it is not always obvious to guarantee that the capability objectives represent the real needs of the company, or to insure that the good practices (the proofs) are necessary and sufficient for the measurement of capability acquisition. Moreover, the capability assessment can be biased by the “learning situation”: an entity can be gauged as capable because its efforts are focused on bringing some proofs of good behavior on the specific requirements given by the organization. But it is not always sure that this capability is really exploited in “usage learning”.
In order to overcome these questions, capabilities assessment (seen as potential performance, between “require” and “acquire” relationships) and results assessment (seen as real performance, between “expect” and “obtain” relationships) could be crossed, so as to study the impact of capability on result (cf. Figure 3). That could enable to verify the capability coherence, by determining if the assessed acquired capability is really useful for the organization. Moreover, it would be a means to detect the issues in capability learning or usage due to the situation. Indeed, as emphasized in (Rauffet(b), 2010), if the capability is not coherent, the internal or external properties of entities can explain that (like the seniority of plants, the geographical context, the type of goods or services delivered…)

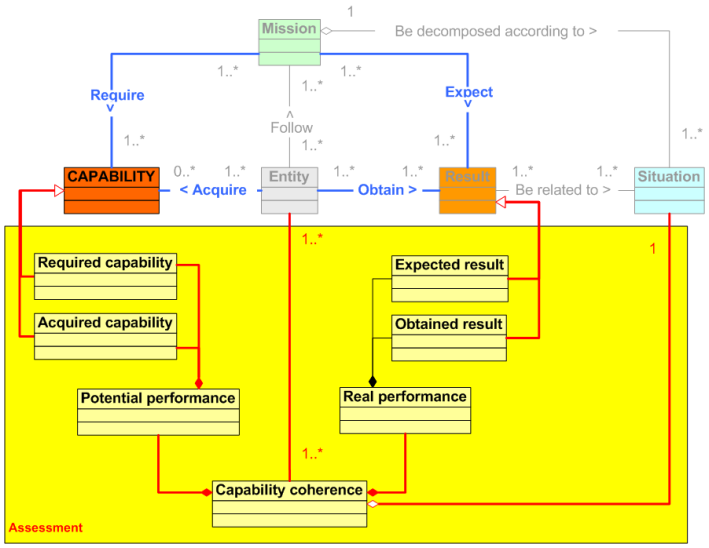

Figure 3. Capability assessment, between potential and real performance

3.2.2. Organizational capability triple loop learning modes

In order to manage organizational capability, it is important to understand how it can be built and how it can sustainably evolves in organization. The state of the art of part 2 mentioned the triple loop learning mechanisms. As underlined in Figure 4, it is therefore necessary to have:

- *A single learning loop support:* The capability learning must be modeled in a pattern, in order to capitalize and structure good practices. This pattern must facilitate the communication in a “many-to-one” way between organization (which defines the required capabilities) and its entities (which acquires the capabilities), and it must also enable to encapsulate the transfer rules which are negotiated between them, like the objectives of capability level or delay to reach. This one is actually the learning schema, which will guide the entity for acquiring the capability. It behaves a path dependency, which can be constituted from several maturity levels.
- *A second learning loop support:* An experience feedback system should be implemented in a “one-to-many” way, so as to provide information on the problems to fix or the opportunities to seize in the learning or the usage of capabilities. That would ease the animation around capabilities, and enable to take into account the situation properties as factor or success or failure in the acquisition and in the usage of capabilities.
- *A third learning loop support :* participative innovation, communication and autonomy around capability must be boosted in a “many-to-many” way, by grouping entities into “communities of practices” directly (the organization suggest to entities to work together to overcome some barriers) or indirectly (an entity find the other entities which are similar to its situation, and can give some clues to progress faster on the capability acquisition).

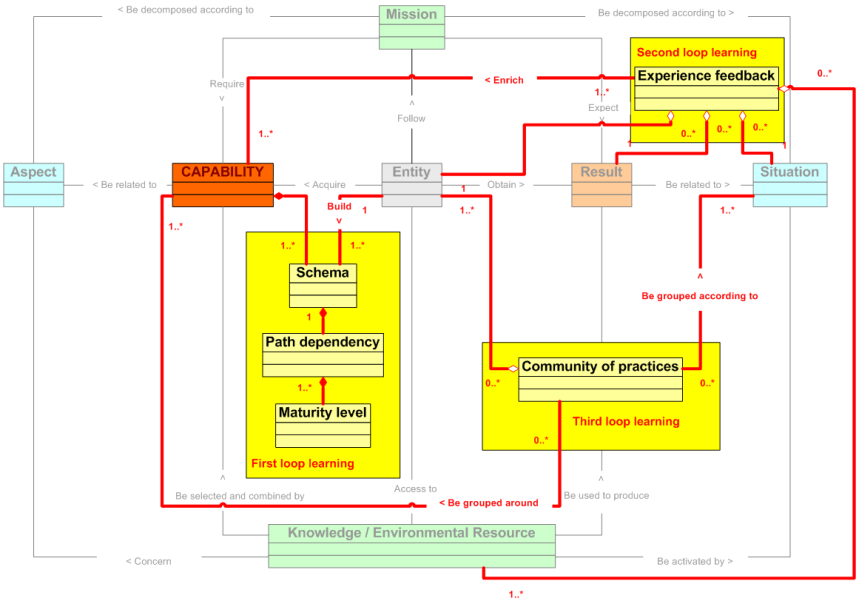

Figure 4. Triple loop learning: transfer and improvement dynamics, with many-to-one, one-to-many and many-to-many interactions

3.2.3. Global management framework

From these mechanisms and modes described above, a global framework (cf. Figure 5) can be proposed for managing organizational capability, its related objects and the relationships between them.
The primary system of this framework is the “organizational capability learning plans management”, where mission are decomposed into capabilities, where good practices are structured around these capabilities and according some maturity levels, before being transferred on operational context. At the local level, entities acquire in a single loop the capability, and assess their progress on the learning plans. These assessments are consolidated and provide some relevant elements to support an diagnosis on the organizational strengths and the weaknesses.
Then some support systems are implemented around this primary system, to sustainably improve it:
- an “organizational capability analysis” system can be designed, to check the capability coherence, by crossing capabilities assessment and results assessments.
- a “feedback management” system can be added, to create a second learning loop, by gathering active users’ feedbacks (an entity declares its problems on a forum, or by mailing a support center for instance) and passive feedbacks (the capability coherence assessment provides information on the potential problems which can exist).
- a “communities of practices management” system can be implemented, to create a third learning loop, by grouping entities according to their similarity of context or their similarity of results. That would boost participative innovation and collaboration to progress on capabilities, and to improve the content of learning plans.

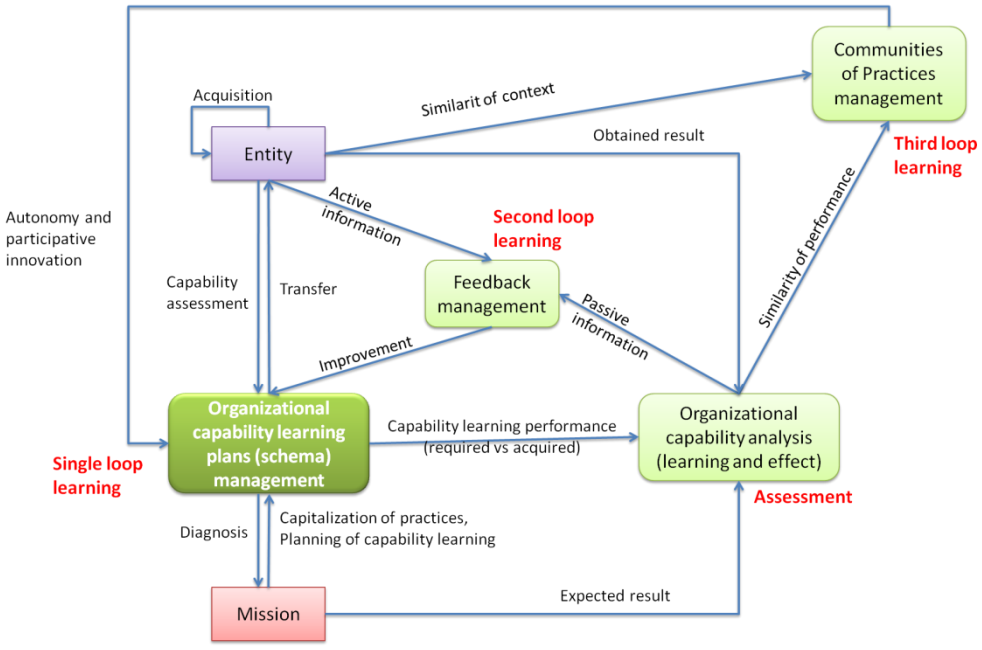

Figure 5. Organizational capability management framework

This part gives the *C-makers* model, the management modes and the global framework to manage organizational capabilities, based on the synthesis of individual competency and quality approach. The next section studies more specifically the use of this model and this

framework in the development of a platform and an additional module to manage operationally organizational capabilities.

4. Applications: development of a platform and a complementary module, and their use in Valeo context

These research works occur in the Pilot2.0 project supported by the French National Agency of Research (ANR, 2007). It involves laboratories (IRCCyN and M-LAB), companies (MNM Consulting, Valeo) and institutional partners (General Council of Vaucluse). The aim of this partnership is to provide a generic methodology and a platform for managing organizational capabilities in extended organizations. The following paragraphs present how a platform is specified according to the previous model *C-makers,* and how a complementary module is added to manage all the dimensions pointed out in the global framework. This platform and this module were tested on the Valeo group and are used to illustrate these developments.

4.1 Roadmapping platform

The roadmapping of management (Blanc and Monomakhoff, 2008) is supported by a pattern, the roadmap, and a software tool. It is used for transferring good practices pattern, integrating new entities, and assessing locally and globally organizational capabilities.

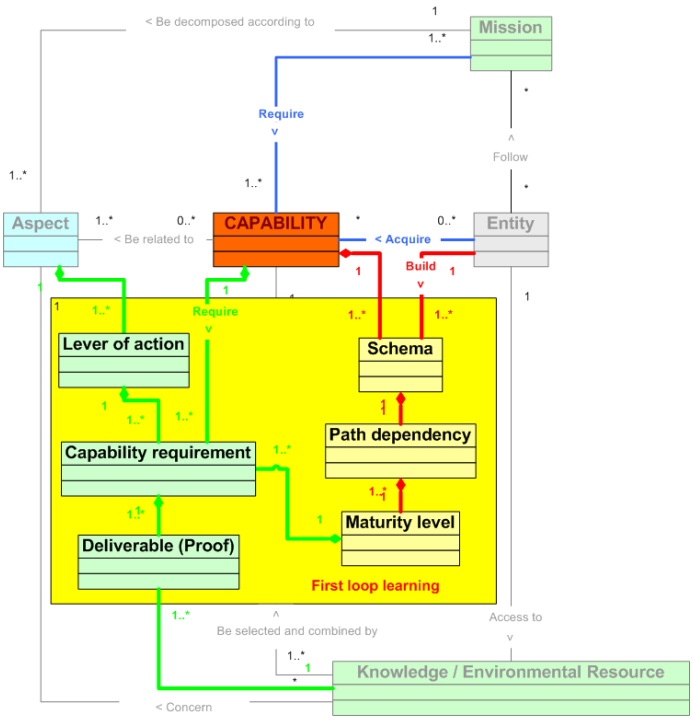

Figure 6. Specification of the model

4.1.1 The roadmap, a pattern for organizational capability learning

The heart of this method is the roadmap pattern, which is a specification of the learning plan presented in Figure 4, which supports the first learning loop. This specification brings some new elements for managing operationally organizational capabilities.

As emphasized in Figure 6, the roadmap pattern introduces a decomposition of the aspects into some “levers of action”. These levers detail the different capability drivers to manage so as to cover all the aspects the capability is related to. For instance, in Valeo, there are about ten generic organizational aspects (policy, technical means, relation with suppliers…), which are specified into some sub-aspects (for instance, policy is decomposed in Figure 7 into objectives and approach and people involvement, so as to model the capability for deploying Valeo’s IT networks).

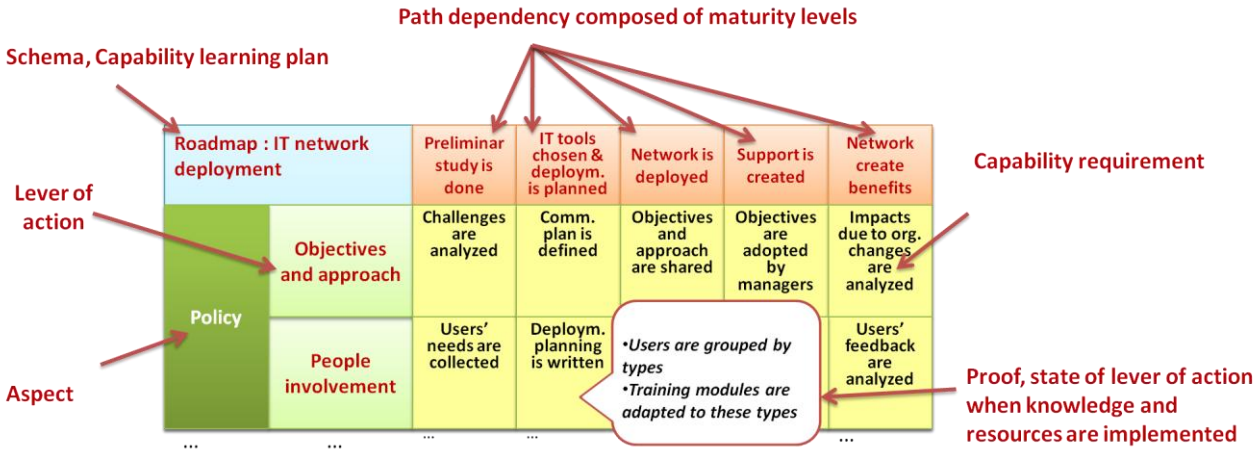

Figure 7. Extract of a Valeo Roadmap for IT network deployment (adapted from (5 steps, 2010))

The capability can be therefore managed according to a matrix pattern (Figure 7), where capability is decomposed into capability requirements, which are the intersection (Figure 6) between a lever of action (to deal with the aspect the capability has to cover) and a maturity level (to deal with the learning path of the capability). Each requirement is then decomposed into deliverables, i.e. the proof elements that the entity must provide, in using knowledge and environmental resource, to guarantee that the capability is acquired.
Moreover, this pattern in not linked with the results assessment, and uses only, like generally in individual competency and quality models, the "required/acquired" difference (cf. Figure 6) to measure organizational capability.

4.1.2 The roadmapping, a method for managing roadmap

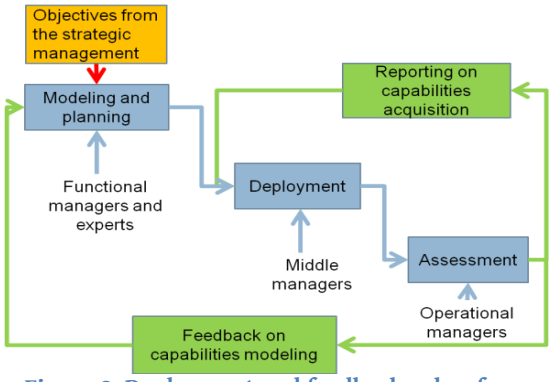

Figure 8. Deployment and feedback rules, for supporting the single and the second learning loops, adapted from (Blanc and Monomakhoff, 2008)

To manage these roadmaps, the roadmapping of management proposes some rules (cf Figure 8). Capabilities are modeled and their learning is planned in roadmap patterns by functional experts according to the objectives given by the strategic management. Then the roadmaps are deployed by the middle management, which discuss the operational objectives (delay, maturity level to reach). Finally, operational managers implement the roadmaps on their local situation. These operational managers have to assess their progress, adapt themselves to what their asked for (in a single learning loop), but they can also give some feedback on the content of roadmap (in a second learning loop).
These mechanisms for managing roadmap patterns are implemented in a full-web SOA platform, developed by MNM-Consulting. This platform is deployed on the whole Valeo group, to manage about 50 organizational capabilities required by 6 functional networks (Information System, Production System, People Involvement, Quality System, Supplier Integration, R&D constant innovation) on about 120 plants. Roadmapping enabled to capitalize and make operational good practices libraries, to introduce more quickly some new practices, like green IT approach (AIM, 2010), to integrate faster newcomers in its

organization, and to keep control on operational excellence and organizational cohesion (Fall, 2008).
In a quantitative way and according to the quality managers of Valeo (HSQE, 2009), the use of roadmaps responsible of decreasing (faulty “parts per million”) by up to 50% in some plants of the group (which is an important indicator for an automotive supplier).
In a managerial view, François Blanc, Director of Information System in Valeo, points out the use of roadmap as a means to give some functional objectives in addition to the operational objective. That enables to have a long-term view on the strengths and the weaknesses of an entity, complementary to the short-term performance view. Indeed, an entity can have for instance good financial indicators on a short-term period, if a manager reduces the number of resources, the number of means of production. However, this reduction can finally trigger off bad performance, because the necessary resources are not enough sufficient. Roadmaps are therefore a means to control the sustainable “good health” of entities, and not only their apparent “fit”.
Roadmapping allows therefore managing organizational capabilities by assessing them according to the « acquired / required » relationship, and by implementing a double loop learning. Nevertheless some issues are identified in the context of Valeo (Rauffet(a), 2009, Fall and Rauffet, 2008) about the people involvement and their participation to the feedback process. It is thus necessary to reinforce this second loop (to insure “vertical ascending many-to-one” communication), and create in addition a real thir loop (to support the “horizontal many-to-many” collaboration).

4.2 Module for “Impacts Analysis and CoPs Detection”

The two identified limits in the implementation of the previous system are:
- the capability assessment based only on the « acquired / required » relationships, but not linked with the study of the capabilities effect on real performance.
- a deficient second loop, due to the weak participation of operational users in feedback process, which do not provide enough information on the situation of learning and use of the capability.
So as to overcome these limits, an additional module was designed. It is currently only a demonstrator, and it is being tested on Valeo data to demonstrate its validity. Its development is based on VBA and some google APIs, so as to ease the data manipulation and a future integration in the roadmapping platform. It allows:
- *Impact analysis:* by crossing capabilities assessment with results assessment based on some statistical dependency methods (Rauffet(c), 2009), so as to analyze the impact of capabilities on real performance. It provides therefore a means to detect if a roadmap models accurately an organizational capability, without unexpected negative secondary effects on some performance indicators (cf. Figure 9, blue box).
- *Singularities analysis and passive feedback:* by enriching the sometimes deficient active users’ feedbacks (i.e. the second learning loop) with some passive information. Because people do not always speak about their operational issue, the analysis of the behavior of a roadmap on all the entities according to a performance criteria (chosen by an expert or obtained by the impact analysis) provides a way to detect entities with out- or under-performance. As emphasized in the green box of Figure, the manager can determine manually the zones of regular and singular performance, by choosing some filter (it can choose a specific geographical zone or a product branch) and list the entities which have an unexpected behavior.

- *Communities of Practices research and creation:* from the singularities analysis or by acting on the filter tools (results indicators, situation properties), some entities can be grouped, in order to create a real third learning loop (cf. green and red boxes of Figure 9). It is a way to propose some local collaboration:
    - Between neighbor regular entities (in performance or/and in situation) to make them progress faster on the capabilities acquisition,
    - Between singular and regular entities, to solve the problems of singular entities by following the example of regular entities
    - Between singular entities, to make them think about the causes of their issues, to look if it is a problem of adaptation of roadmaps on certain situations, or to detect opportunities to enrich roadmaps by new good practices in the case of out-performance entities.

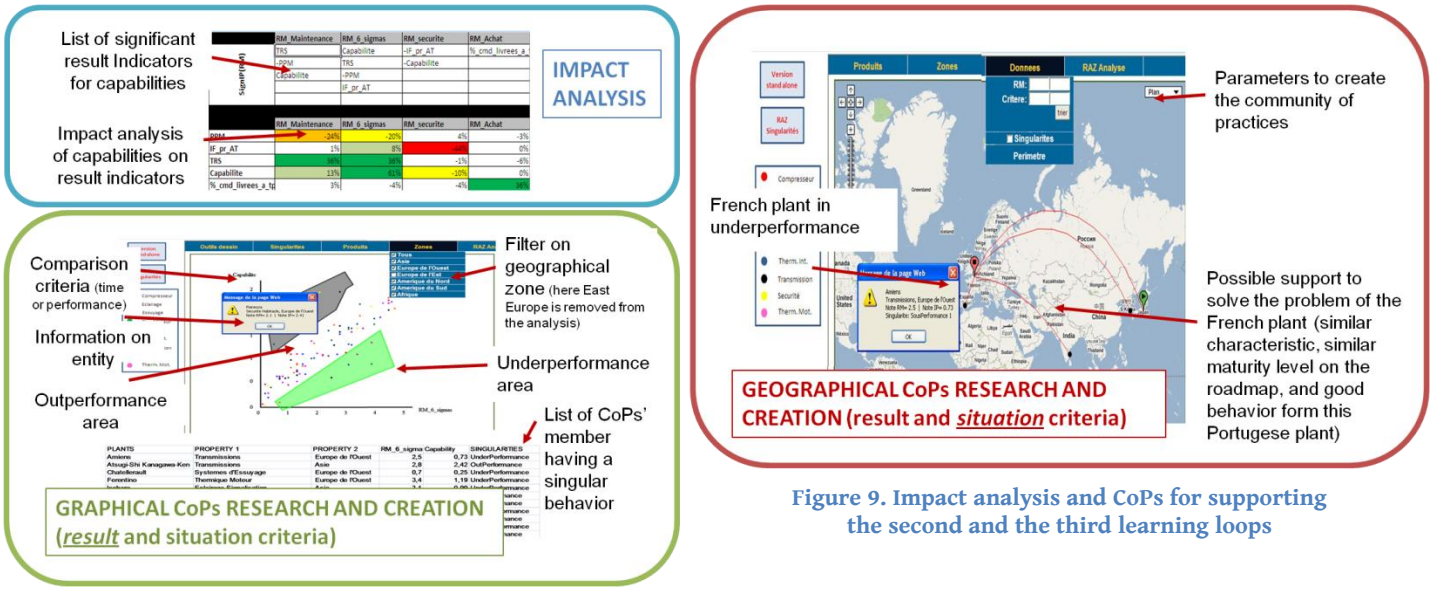

Figure 9. Impact analysis and CoPs for supporting the second and the third learning loops

This additional module is currently tested on Valeo context. Its first results show that it would enable to detect more quickly the problems in organizational capability management by studying the secondary effects of roadmap patterns, by taking into account the situation of learning and use of capability at the operational level, and by boosting participative innovation by creating local communities of practices.

5. Concluding discussion

This paper pointed out the lack of a model to manage collective competencies with a resource-based view (called here organizational capabilities). Indeed either the existing methods tried to aggregate the results obtained by the models of individual competency management (CRAI, CSM), or they used a "qualification" approach at a collective level by determining the adequacy of entities to some predefined processes (CMMI, ISO).

The model *C-makers* is therefore built in order to manage the problem of organizational capability management with the accurate view and at the good level. Moreover, by placing on this model the dynamic mechanisms of the organizational capability assessment and its triple loop learning, a management framework emerged from the analysis.

All this conceptual material enabled to support the specified design of the roadmapping platform and the development of an additional module, to manage operationally organizational capabilities. As emphasized in Figure 10, these 2 specifications of the

management framework allow obtaining the operational tools, which complementary cover all the dimensions of organizational capability management. All or part of these tools were already tested in the Valeo group context, and give some first encouraging results.
The future research works will continue to focus on the validation of the additional module for the impact analysis and the creation of CoPs in the context of Valeo group. Indeed it is necessary to further study how this complement would enable to take into account the environmental factors of the entities in the capability learning and use.

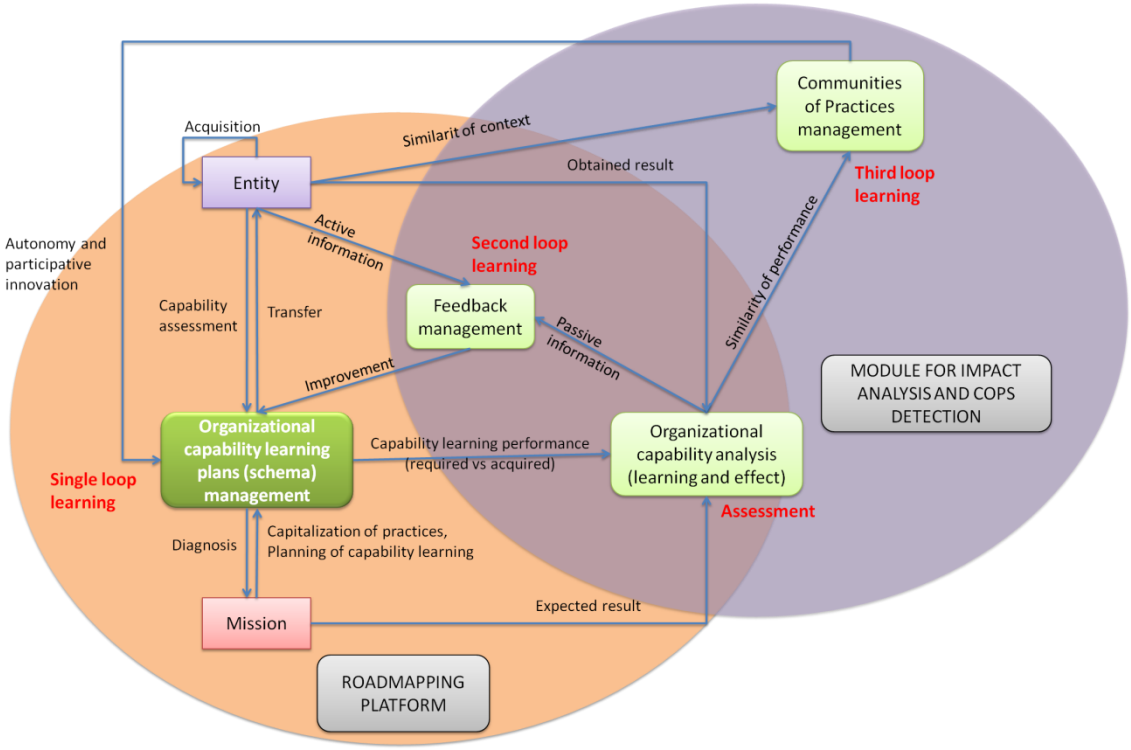

Figure 10. Position of the two specified tools on the global framework

6. Acknowledgement

The authors would like to thank the ANR (National Research Agency) which supports the Pilot2.0 project, as well as François Blanc (Director of Information System of Valeo group), Nicolas Monomakhoff (Head of MNM Consulting), Ibrahima Fall (ex-PhD student in MNM Consutling), Roland Alech (Project Manager in MNM Consulting) and Michel Labrousse (Responsible of the Research department in MNM Consulting), who provided their precious advices and shared their operational experience on the roadmapping to build scientific and pragmatic model and framework for managing organizational capabilities.

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